The Application of COCONet to Determine Water Vapor Variability in the Caribbean

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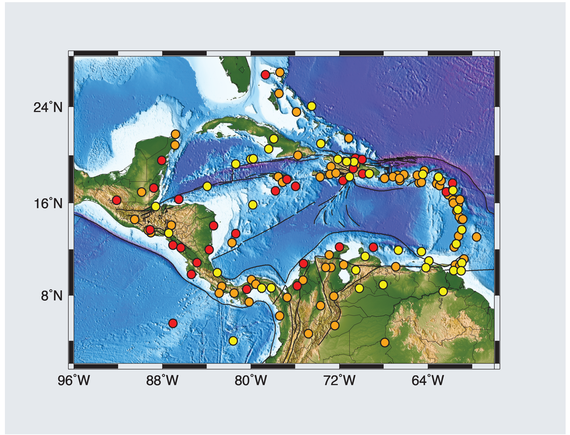
Introduction

The Continuously Operating Caribbean Observational Network (COCONet) is a geohazards (atmospheric and tectonic) project focused on infusing large-scale state of the art observational infrastructure into the Caribbean and Latin America (Braun et al, 2012). COCONet is a collaborative project funded by the United States National Science Foundation. From an atmospheric perspective, it provides an opportunity to collect continuous measurements of total column precipitable water vapor (GPS-PWV), as well as surface measurements of temperature, relative humidity, pressure, horizontal winds and precipitation across the entire Caribbean basin.

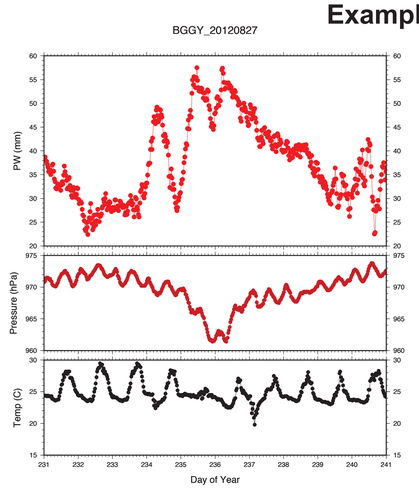
COCONet will establish a network of 46 new continuous Global Positioning System (cGPS) and meteorology stations, refurbish an additional 21 stations, and archive data from 61 cGPS stations that are already or will soon be in operation (right). Significant progress has been accomplished in the initial 26 months of the project. UNAVCO Engineers have performed site reconnaissance at 57 locations in 24 countries, are securing land use permits for 48 sites and currently have 25 stations installed or refurbished. The network is expected to be fully operational by the end of 2013.

Network Status

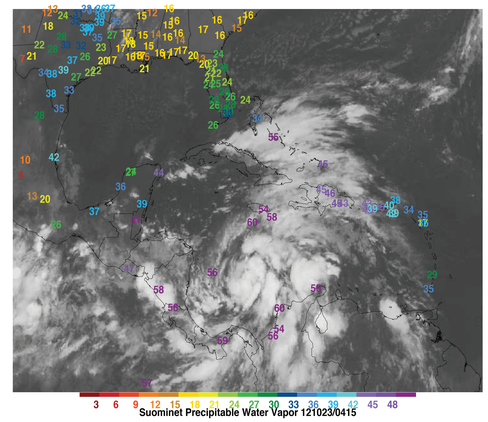


Status of new and/or refurbished stations (red), existing stations (orange), and future stations (yellow) that are part of COCONet. Twelve COCONet stations will be within ~10km of radiosonde sites. Map courtesy UNAVCO (D.Mencin, M. Berg, K. Feaux), Dec 2012.

Example Data Products



Time series of GPS-PWV (top), surface pressure (middle), and temperature (bottom) taken from existing COCONet station BGGY in Antigua. Hurricane Issac passed closest to the site on day 236.



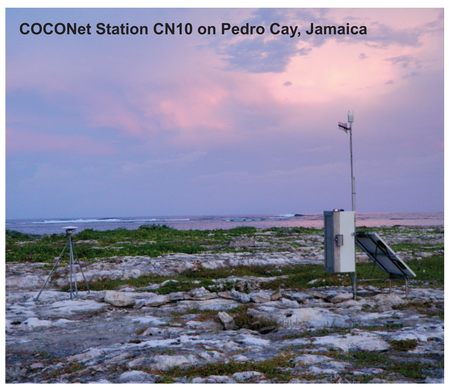
GPS-PWV estimates overlaid upon GOES-IR image as Hurricane Sandy (2012) develops south of Jamaica.

Instrumentation

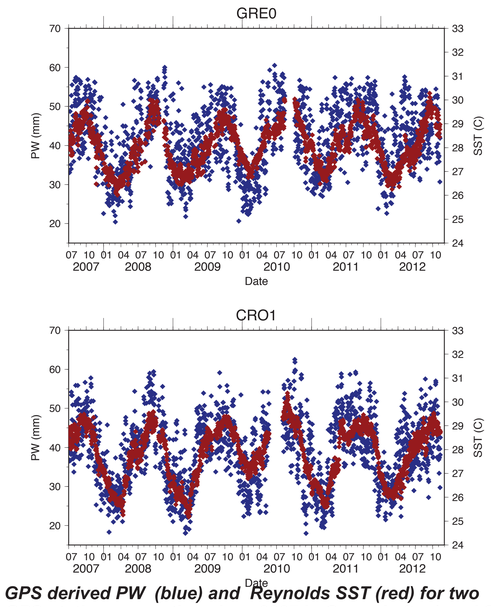
Each COCONet station is equipped with a high precision GPS system and a Vaisala WXT-520 surface meteorology instrument. Examples of COCONet installations are shown.

All COCONet stations will have sub-daily data latencies. Typical data communications systems include direct access through a host institution's computer network, a DSL line through from the local telephone company, cellular modems, or satellite communications.

The sites have redundant power systems, including enough backup battery power to allow the system to collect multiple days of data before powering down.

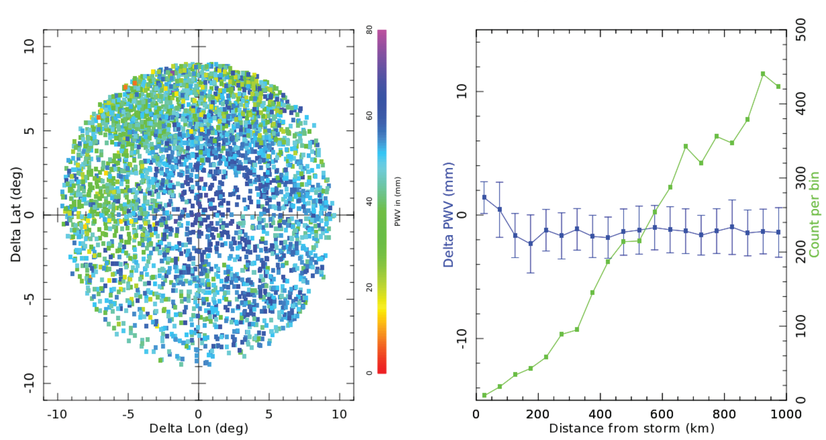


PW Correlation to Sea Surface Temperatures



GPS derived PW (blue) and Reynolds SST (red) for two GPS stations operating since 2007 in Grenada (top) and St. Croix (bottom).

GFS PW Error in GFS Analysis Fields



GPS derived PW (left) estimated from more than 40 tropical storms and hurricanes (category 0-2) between 2007-2011. PW estimate is plotted as a function of latitude and longitude distance from the National Hurricane Center (NHC) best track location. Difference between GPS derived PW and GFS analysis field as a function of radial distance from the storm location (right). Relative to GPS, the GFS analysis field appears dry from 0-200 km and wet outside of 200 km. Analysis from SOARS protegee V. Almanza, San Francisco State University (now at U. Hawaii).

Data Products and Availability

COCONet will provide raw GPS data, GPS-PWV, surface meteorology measurements, time series of daily positions, as well as a station velocity field to support a broad range of geoscience investigations. All the new and refurbished stations will have sub-daily data latency. Atmospheric data products will be distributed to the researchers using both the Unidata Local Data Manager (LDM) and other web Internet distribution systems. Geodetic data products will be available from the UNAVCO public data archive and potential regional data partners in the Caribbean. All of the participants in the project have committed to a free and open data policy.

http://www.suominet.ucar.edu/data/index.html
LDM Data Stream, http://www.unidata.ucar.edu/software/ldm , Primary name = GPS, Feedtype = FT18
http://www.unavco.org/crosscutting/cc-data.html

Capacity Building

One theme of the project is the need to build a bidirectional scientific partnership to nurture a new generation of researchers in the region. COSMIC/UCAR has recently received funding from the National Science Foundation to conduct a short-course on atmospheric processes of Latin America and the Caribbean. This short course is an attempt to foster a community of scientists who are interested in regional atmospheric processes, and as a way of introducing these researchers to the Continuously Operating Caribbean Observation Network (COCONet). This two-week short short-course will be held from May 27 - June 7 2013 in Cartagena, Colombia.

2013 Pan American Advanced Studies Institute (PASI)
Atmospheric Processes in Latin America and the Caribbean: Observations, Analysis, and Impacts.
May 27 – June 7, 2013
Cartagena, Colombia
www.cosmic.ucar.edu/pasi2013

Collaborators

COCONet is a collaborative research project. Investigators from the United States include Dr. Meghan Miller (UNAVCO), Dr. Glen Mattioli (UNAVCO), Dr. Eric Calais (Purdue), Dr. Guoquan Wang (Univ. Houston), and Karl Feaux (UNAVCO). A full list of international partners (more than 35) can be found at http://coconet.unavco.org/people/people.html.

Acknowledgements

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References

Braun, J. J., G. Mattioli, E. Calais, D. Carlson, M. Jackson, R. Kursinski, M. Miller, R. Pandya, 2012: Multi-disciplinary natural hazards research initiative begins across Caribbean basin, EOS. Transactions of the American Geophysical Union, Vol 93, No 9, doi:10.1029/2012EO090001.